CLAIMS

1. A method for generating a control program for a machine tool, said machine tool having at least one sequence of sets of control data for the machining of a workpiece by means of operating units controlled by the control program, wherein:

for generating the control program a virtual workpiece and at least one virtual operating unit are represented to a user by a data processing unit,

each individual, virtual operating unit is addressed by the user and virtual action(s) are specified via a data input unit, and

the action(s) specified to each individual, virtual operating unit are converted automatically into sets of control data of the control program by the data processing unit taking into account a machine and control configuration specified to it.

2. A method as defined in claim 1, wherein all of the virtual operating units of the machine tool are represented to the user in accordance with an actual machine configuration in the form of a machine display.

3. A method as defined in claim 2, wherein all of the virtual operating units and their virtual actions are represented, taking into account the machine and control configuration of the machine tool.

4. A method as defined in claim 1, wherein the virtual operating units and their virtual actions are represented for the user after they have been addressed and specified.

5. A method as defined in claim 1, wherein a linking of virtual operating units specified in a defined manner is carried out automatically by the data processing unit in order to take into account the machine and control configuration.

6. A method as defined in claim 1, wherein the machine and control configuration is taken into account with the aid of a machine model comprising information concerning linkings of the virtual operating units representing the machine and control configuration.

7. A method as defined in claim 6, wherein the machine model comprises a basic configuration of the virtual operating units of the machine tool extendible by the user.

8. A method as defined in claim 6, wherein the machine model is generated by means of stored linking information.

9. A method as defined in claim 6, wherein the machine model linking the individual, virtual operating units of the machine tool in accordance with the machine and control configuration is stored in the data processing unit.

10. A method as defined in claim 6, wherein the machine model is utilized in the data processing unit in the form of a data tree structure.

11. A method as defined in claim 9, wherein the data tree structure has the form of a hierarchical data tree structure.

12. A method as defined in claim 1, wherein for each virtual operating unit the machining operations realizable therewith are ascertained automatically by the data processing unit.

13. A method as defined in claim 12, wherein a set of filter data is generated for ascertaining the realizable machining operation.

14. A method as defined in claim 13, wherein the set of filter data is generated on the basis of the machine and control configuration.

15. A method as defined in claim 13, wherein the set of filter data is ascertained independently by the data processing unit in accordance with the machine and control configuration.

16. A method as defined in claim 13, wherein a list of machining operations performable with the respective virtual operating unit is selected from a list of all the possible machining operations with the set of filter data.

17. A method as defined in claim 16, wherein the list with the machining operations allocated to the respective virtual operating unit is presented so as to be selectable for a user.

18. A method as defined in claim 12, wherein the sets of control data for the control program are ascertained automatically by the data processing unit on the basis of the

addressed, virtual operating unit and the virtual machining operation correspondingly selected.

19. A method as defined in claim 1, wherein the change in shape of a virtual workpiece due to machining thereof is represented by means of virtual actions of the virtual operating units.

20. A method as defined in claim 19, wherein the change in shape of the virtual workpiece is ascertained by way of a cut calculation.

21. A method as defined in claim 1, wherein the sets of control data of the control program are decoded and interpolated by the data processing unit in the same way as in a decoder and an interpolator of the machine control for the operating units of the machine tool.

22. A method as defined in claim 21, wherein the virtual actions of the virtual operating units are ascertained and represented during the interpolation using the machine and control configuration.

23. A method as defined in claim 22, wherein the machine model is used during the interpolation for ascertaining the virtual actions.

24. A method as defined in claim 19, wherein the machining of the virtual workpiece is represented at any time on said virtual workpiece.

25. A method as defined in claim 1, wherein the virtual actions of the virtual operating units are visualized in a machining sequence provided for a machining of the virtual workpiece or in a reverse machining sequence.

26. A method as defined in claim 25, wherein in addition to the sets of control data, auxiliary data allowing a visualization of the virtual actions in a reverse machining sequence are generated for each set of control data taking into account the machine tool and control configuration.

27. A method as defined in claim 26, wherein the auxiliary data are allocated to each set of control data in the form of a set of auxiliary data.

28. A method as defined in claim 27, wherein the sets of auxiliary data are stored in a chained list.

29. A method as defined in claim 27, wherein the set of auxiliary data comprises a set of transition and/or status data.

30. A method as defined in claim 1, wherein shape data of the virtual workpiece are ascertained for each set of control data.

31. A method as defined in claim 30, wherein the shape data are stored in the set of auxiliary data.

32. A method as defined in claim 28, wherein not only the control program but also the chained list is accessed and the

corresponding set of auxiliary data are read from the chained list for each set of control data.

33. A method as defined in claim 32, wherein not only the set of control data to be processed but also the associated set of auxiliary data are determined at the same time by the data processing unit.

34. A method as defined in claim 28, wherein the chained list is stored and a set of auxiliary data is clearly allocated to each set of control data.

35. A method as defined in claim 26, wherein sets of control data and auxiliary data are recorded with the data processing unit in machining sequence or in reverse machining sequence and represented by the virtual operating units and virtual actions.

36. A programming system for generating a control program to provide machining of a workpiece by means of operating units of a machine tool, comprising:

a data input unit for entering and/or changing information determining the control program of the machine tool,

a visualization device for representing said information, and

a data processing unit adapted to convert the information into sets of control data determining the control program and storing these in a program memory, wherein:

the data processing unit comprises a model visualization unit designed such that with it at least one

virtual operating unit of the machine tool and its virtual actions are representable by means of said visualization device,

the model visualization unit interacts with the data input unit such that the virtual operating unit(s) are addressable via the data input unit and virtual actions are specifiable to these virtual operating units, and

with the model visualization unit the virtual actions specified to the individual, virtual operating units are convertible into the sets of control data of the control program taking into account the machine and control configuration.

37. A programming system as defined in claim 36, wherein with the model visualization unit, all of the virtual operating units of the machine tool are representable on the visualization device in the form of a machine display, in accordance with the actual machine configuration.

38. A programming system as defined in claim 36, wherein the model visualization unit represents the virtual operating units and their virtual actions on the visualization device taking into account the machine and control configuration of the machine tool.

39. A programming system as defined in claim 36, wherein the model visualization unit represents the virtual operating units and their virtual actions on the visualization device after they have been addressed and specified.

40. A programming system as defined in claim 36, wherein a linking of virtual operating units specified in a defined manner takes place by means of a model configuration unit

interacting with the model visualization unit, in order to take into account the machine and control configuration.

41. A programming system as defined in claim 36, wherein the machine and control configuration is taken into account with the aid of a machine model generated by the model visualization unit, said machine model comprising information concerning linkings of the virtual operating units representing the machine and control configuration.

42. A programming system as defined in claim 41, wherein the machine model comprises a basic configuration of the virtual operating units of the machine tool extendible by the user.

43. A programming system as defined in claim 41, wherein the machine model is generatable by means of linking information from a model configuration unit.

44. A programming system as defined in claim 41, wherein the data processing unit has a main memory for storage of the machine model linking the individual, virtual operating units of the machine tool in accordance with the machine and control configuration.

45. A programming system as defined in claim 41, wherein the machine model is available to the data processing unit in the form of a data tree structure.

46. A programming system as defined in claim 45, wherein the data tree structure has the form of a hierarchical data tree structure.

47. A programming system as defined in claim 36, wherein a function allocation unit is allocated to the model visualization unit, the machining operation realizable with each virtual operating unit being ascertainable for each operating unit with said function allocation unit.

48. A programming system as defined in claim 47, wherein a set of filter data is generatable for ascertaining the realizable machining operation.

49. A programming system as defined in claim 48, wherein the set of filter data is generatable on the basis of the machine and control configuration.

50. A programming system as defined in claim 48, wherein the model configuration unit generates the set of filter data in accordance with the machine and control configuration and transmits this set of filter data to the function allocation unit.

51. A programming system as defined in claim 48, wherein with the set of filter data, the function allocation unit selects from a list of all possible machining operations a list of machining operations performable with the respective virtual operating units.

52. A programming system as defined in claim 51, wherein the function allocation unit presents the list with the machining operations allocated to the respective virtual operating units via the model visualization unit so as to be selectable for a user.

53. A programming system as defined in claim 47, wherein the model visualization unit automatically ascertains the sets of control data for the control program on the basis of the addressed operating unit and the virtual machining operation selected accordingly.

54. A programming system as defined in claim 36, wherein the model visualization unit represents the change in shape of a virtual workpiece by way of machining thereof by means of virtual actions of the virtual operating units.

55. A programming system as defined in claim 54, wherein the change in shape of the virtual workpiece is ascertainable by way of a cut calculation unit.

56. A programming system as defined in claim 36, wherein the model visualization unit has a decoder and an interpolator for the sets of control data of the control program corresponding to a decoder and an interpolator of the machine control for the operating unit of the machine tool.

57. A programming system as defined in claim 56, wherein the interpolator ascertains the virtual actions of the virtual operating units using the machine and control

configuration and the model visualization unit represents these on the visualization device.

58. A programming system as defined in claim 57, wherein the interpolator is used to ascertain the virtual actions of the machine model.

59. A programming system as defined in claim 54, wherein the model visualization unit is designed such that the machining of the virtual workpiece is representable at any time on said virtual workpiece.

60. A programming system as defined in claim 36, wherein the virtual actions of the virtual operating units are visualizable in a machining sequence provided for a machining of the virtual workpiece or in a reverse machining sequence.

61. A programming system as defined in claim 60, wherein in addition to generating said sets of control data, the model visualization unit generates auxiliary data for each set of control data taking into account the machine tool and control configuration, said auxiliary data permitting a visualization of the virtual actions in a reverse machining sequence.

62. A programming system as defined in claim 61, wherein the model visualization unit allocates the auxiliary data to each set of control data in the form of a set of auxiliary data.

63. A programming system as defined in claim 62, wherein the model visualization unit stores the sets of auxiliary data in a chained list.

64. A programming system as defined in claim 62, wherein the set of auxiliary data comprises a set of transition and/or status data.

65. A programming system as defined in claim 36, wherein the model visualization unit ascertains shape data of the virtual workpiece for each set of control data.

66. A programming system as defined in claim 65, wherein the model visualization unit stores the shape data in the set of auxiliary data.

67. A programming system as defined in claim 63, wherein the model visualization unit is designed such that it accesses not only the control program but also the chained list, and the corresponding set of auxiliary data is readable from the chained list for each set of control data.

68. A programming system as defined in claim 67, wherein the model visualization unit determines by means of an indicator unit not only the set of control data to be processed, but also the associated set of auxiliary data.

69. A programming system as defined in claim 61, wherein the model visualization unit is designed such that with it sets of control data and auxiliary data are recordable in machining sequence or in reverse machining sequence and are

representable by way of the virtual operating units and virtual actions.

70. A programming system as defined in claim 63, wherein the data processing unit has a system program memory for storing the control program.

71. A programming system as defined in claim 70, wherein the chained list is stored in the system program memory and that a set of auxiliary data is clearly allocated to each set of control data.